

EXHIBITIONS AND NOTICES.

May 23rd, 1916.

Dr. HENRY WOODWARD, F.R.S., Vice-President,
in the Chair.

Mr. E. G. BOULENGER, F.Z.S., Curator of Reptiles, exhibited living specimens of the African Lungfish (*Protopterus annectens*), presented to the Society by Capt. C. W. Woodward.

The Rev. H. N. HUTCHINSON, M.A., F.Z.S., exhibited the plaster cast of a model, four feet long, which he had constructed, of the Dinosaur, *Diplodocus carnegiei*.

The object in making the model was to express in a solid form his views on the reconstruction and articulation of the skeleton of *Diplodocus*, with special reference to the plaster-cast of a reconstructed skeleton now in the British Museum (Nat. Hist.), and presented by Mr. Andrew Carnegie in 1905.

The late Dr. J. B. Hatcher, Dr. W. J. Holland, and others who have published papers on *Diplodocus* appear to be so anxious to make this extinct reptile appear very tall and impressive, that they have been so bold as to place the limbs in an upright position, as if the creature were an elephant. On the other hand, many naturalists, recognising the Sauropoda to be related to the Crocodilia, are persuaded that the limbs should be placed at an angle to the body somewhat as in the Lacertilia, a view which the speaker has expressed on the above model. He has tried to show that the articulations of the femur and the humerus are mechanically impossible. The broad spatulate end of the latter he thinks should not be put at right angles to the plane of the scapula and glenoid cavity, but must be turned round 90 degrees so as to come properly into line with the large surfaces of the scapula and coracoid.

A rare Fish.

Mr. C. TATE REGAN, M.A., F.Z.S., exhibited a specimen of a rare fish, *Centrolophus britannicus* Günth. This species was described from a fish about 500 mm. long, which was washed ashore near Polperro in February 1859 (Günth, Cat. Fish. ii. p. 402, 1860). No other specimen was recorded until one of nearly the same size as the type was taken near Cornuã in December 1904 (Cligny, Ann. Stat. Aquic. Boulogne, n. s. i. 1905, p. 75). A third example, of the same size as the others, was taken from the water in a dying condition, after a storm, at Capbreton, in March 1908 (Pellegrin, Bull. Soc. Zool. xxxvii. 1912, p. 20). The fish exhibited was the fourth known example of this species. It was landed in South Wales from the trawler

'Caswell,' and was sent by Mr. H. E. Rees to Mr. James V. Pryor at Cambridge; not recognizing the species, Mr. Pryor showed it to Professor Stanley Gardiner, and on his advice sent it to Mr. Regan.

Mr. Rees had kindly given the following information:—"The fish was caught by the steam trawler 'Caswell' on Sunday, May 7th, at 3 P.M. The vessel was fishing 95 miles S.S.E. of the Bull Rock, Ireland, in 300 fathoms of water. The fish was caught in the trawl on the sea-bottom and was alive when it was brought in on deck."

The fish is nearly 400 mm. long; it has 53 dorsal and 31 anal rays. The principal differences between *C. britannicus* and the more abundant *C. pompilus* appear to be as follows:—

C. britannicus.—D. 46-53. A. 28-33. About 240 scales in a longitudinal series above lateral line, which has a curve in the anterior $\frac{1}{5}$ of its length. Length of head $5\frac{1}{2}$ to 6 in length of fish.

C. pompilus.—D. 37-41. A. 23-25. 185 to 205 scales in a longitudinal series above lateral line, which has a long curve, becoming straight above origin of anal fin. Length of head 4 to 5 in length of fish.

Mr. Regan also exhibited a Silver Ling (*Molva elongata*), nearly 600 mm. long, taken from the stomach of a very large Sun-fish (*Mola mola*) that had been caught in a trawl, landed at Milford, and sent to Mr. W. Howlett of Billingsgate Market, who presented it to the Natural History Museum. The Sun-fish appears generally to swim near the surface and to eat small invertebrates, larval fishes, etc. It is interesting to note that it may descend to considerable depths (*M. elongata* is usually found at 100 to 300 fathoms) and that it may capture fairly large and active fish.

Albinism in American Animals.

Dr. R. W. SHUFELDT, C.M.Z.S., communicated the following notes on cases of albinism seen in American animals:—

"During the past half century I have noted and examined a great many instances of albinism in various parts of the United States, and as this condition is of interest from several points of view, I am presenting here a few notes I have made upon the subject. It is generally supposed that we may meet with albinos in any type of animal now to be found in existing faunæ in any part of the world; but, strange to relate, there are certain groups of animals, representatives of which seem to be exempt from it. Moreover, while we know very accurately what constitutes albinism, whether partial or complete, we do not know, in so far as I am aware, the precise cause of it, when manifested in any particular individual. There are those who are disposed to consider it simply as a 'freak of nature,' an opinion that I

cannot see my way to accept; for such an explanation stands for nothing more than a cloak to our ignorance of the basic cause of the condition. Why we should find, for example, in a brood of crows, three normally plumaged and the remaining one an albino, has not, in my opinion, ever been satisfactorily explained.

"Among American fishes I have seen living examples of albino brook trout, flounders, eels, and others; while in the case of the common or golden carp albinos are not infrequently met with in nature. Salamanders and frogs occasionally exhibit it among the Batrachians, while examples of it have been observed in the case of certain snakes, 'horned toads,' and lizards. But in so far as my personal experience goes, I have never met with an albino turtle or a tortoise, although I have seen very pallid examples of our common box-tortoise (*Terepepe carolina*).

"Of all the Vertebrata birds seem to constitute the group most frequently exemplifying this condition, and I have personally examined or collected cases of complete or partial albinism, representing nearly every family of them. For the most part, this has been seen in the case of loons, gulls, ducks (teal and mallard), certain waders, sora rail, snipe, woodcock, quail, grouse, turkey, various owls and diurnal raptors, whippoorwill, and in not a few passerine birds as crows, ravens, robins, bluebirds, finches, and others.

"Whilst writing this I have a fine specimen of a 'piebald' robin in my collection, which I collected in Connecticut in 1868.

"American mammals frequently afford examples of either partial or complete albinism, and a few years ago, I had, for a short time, in my possession an unusually fine living example of our common woodchuck (*Arctomys monax*). On the day following its arrival I succeeded in obtaining some fine photographic negatives of the animal, and a photograph from the best one of these is exhibited.

"Other United States mammalian albinos collected or seen by me have been examples of prairie marmots (*Cynomis*), Virginia deer, muskrat, beaver, bats, porcupine, rabbits and hares, squirrels, and some few other forms."

June 6th, 1916.

Prof. E. W. MACBRIDE, D.Sc., F.R.S., Vice-President,
in the Chair.

At this meeting an informal discussion took place on the results published in the 'Biologia-Centrali-Americana,' with special reference to the zoo-geographical relations between America and Africa, of which the following is a brief résumé:—

Dr. F. DUCANE GODMAN, F.R.S., F.Z.S.—In compliance with a request from the Publication Committee of this Society, I have

made a few notes which may serve as a prelude to the discussion on the results recorded in the work published by Osbert Salvin and myself—the *Biologia Centrali-Americana*.

Salvin and I were at Cambridge together, and after leaving the University in 1857 Salvin visited Guatemala to report upon the nuts of a Palm which it was thought might be used in the manufacture of candles. The nuts, however, proved useless for practical purposes, so he devoted some months travelling about the country collecting Birds, Insects, and Plants. Salvin subsequently made three further expeditions to Guatemala with the sole object of continuing his Natural History pursuits—in 1859, and in 1861, on which occasion I accompanied him, returning after about a year's absence, and again in 1865, when he also visited Panama. We trained and employed many of the natives to assist us, and some of them continued to send us specimens for over 30 years.

Salvin and I were immensely struck and delighted with the richness and variety of the fauna and flora found in a tropical country, but it was the revolution in thought produced by the publication of the 'Origin of Species' by C. Darwin, and the promulgation of the theory of evolution, which gave such an intense interest to the subject. I well remember the violent opposition with which this new doctrine was received, and it is difficult for those of the present generation to realize the bitterness with which this new idea was received by all classes. Salvin and I had both read the 'Origin' before our visit to Guatemala, but it was not till after our return that in working out our collections the truth of the new doctrine was fully realized. From that time we took a deeper interest in all our work, and now many problems that had puzzled us were solved. Although we had written several papers in the *P. Z. S. and Ent. Soc. Trans.*, we were still without any idea of publishing the result of our travels in a more collected form.

In 1876 it was suggested that the 'Biologia' should be undertaken, and three years after the first part appeared. It was then estimated that the whole of the Zoology might be completed in 60 parts, but owing to the ever-increasing material this subject alone occupied 215 parts.

After we had been at work for some time we found ourselves very short of Mexican and North-American material wherewith to compare our Central American specimens, and to remedy this, in 1888 I made an expedition to Mexico and spent some months collecting in various parts of the country. For the Birds of North America I was fortunate enough to be able to purchase the Henshaw collection, which was very rich in species from the United States, and which Mr. Ridgway kindly examined for me, critically revising the names and localities. Up to this time collections of North-American birds in this country were very meagre.

A few words on the physical aspect of the country are perhaps

necessary here, but as this subject has been dealt with at length in the Introduction, I will only refer to its general characteristics. Northern Mexico consists of a high tableland, the extension of the Arizona plateau; it is very arid and consequently barren, growing cacti and other such plants. At the spot where the railway crosses the Rio Grande at El Paso, on the borders of Mexico, the plateau descends to only 3700 feet, but soon rises again and has an average altitude of about 8000 feet, till at the end of some 900 miles the City of Mexico is reached. This plateau is bounded on each side by ranges of mountains descending abruptly towards either coast and clothed with forest, which at its summit consists largely of pines and ilex. Both on the Atlantic and Pacific coasts there is a narrow belt of tropical country. About the City of Mexico the plateau is broken by a series of volcanoes, the highest of which reaches 18,000 feet. Southward to Panama the land gradually descends in altitude; it is, however, very much varied and frequently covered with forest, alternating with savannas and interspersed with many volcanoes, one of which in Costa Rica attains a height of 11,000 feet. At the Isthmus of Panama the land subsides to 300 feet.

The country is divided by the natives, according to altitude, into zones under the names of *Tierra caliente*, *Tierra templada*, and *Tierra fria*, and these zones have an immense influence on the fauna and flora, and are a largely determining factor in the number and diversity of species. The climatic conditions must also be taken into consideration, the rainfall on the Atlantic being far in excess of that on the Pacific, and the vegetation far more luxuriant.

In Eocene or early Miocene times there was a broad channel separating North and South America, where the Isthmus of Panama now exists, and it seems probable that a series of elevations and subsidences took place, temporarily forming islands before the land became permanently continuous as it now is, thus accounting for the many allied and representative species found in Chiriqui and Costa Rica.

When the channel was in existence it must have proved an insuperable barrier to the migration of land-animals, but when the two continents became united undoubtedly a considerable interchange of animal- and plant-life took place, and there was a mingling of northern and southern forms. This, no doubt, accounts for the extraordinary richness in species of Central America.

Mr. Pocock, in his remarks on the origin of the Mammalia, says that during Miocene times, when the Panama land-bridge was upheaved, the migration was divided into two categories, one containing the Insectivora, Carnivora, Artiodactyla, Perissodactyla, etc., which had been evolved in the northern hemisphere and inferentially passed from North into South America, while the other comprised the Primates, the Edentates, the Marsupials,

and part of the Rodents, which migrated from South into Central or North America. Birds, which, from their power of flight and habit of migration common to a large number of them, are much more easily distributed than most vertebrates, *do not* throw the same light on geographical distribution as is the case with more sedentary animals. This must, however, be applied in a general sense, as many of the species are extremely local. Nearly half the 1413 species are endemic; but a very large number are migrants from the United States, spending the winter in Central America and returning again in spring. There are, however, two remarkable instances which I may mention. The family of the Tinamidæ, which are essentially ground-birds, rarely fly, and are frequenters of the forest. Members of this family range from Chili to Mexico. They are of a very ancient type, probably allied to the Ratitæ, and must have passed *by land* to Central America. The Trogons, on the contrary, have a very wide distribution; they are strictly tropical, and are also frequenters of the forest, but, unlike the Tinamidæ, have a very extended range, being also found in Oriental regions, and a single species of a peculiar genus occurs in Africa. Remains of a fossil Trogon have been found in the Miocene of France.

It seems probable that South America may have had a land communication with Africa at some remote period, and America may have received some of its characteristic forms from that continent. There is also some reason to suppose that there may have been a land communication with Australia, though this seems more remote. But this is a subject which I hope may be discussed later.

As regards the Insects, which form so large a portion of the work, little can be said as to their distribution at present, and it will be well to wait till more is known of those of other countries; at present the geological evidence is but scanty.

Salvin and I had intended, on the conclusion of the 'Biologia,' to have discussed the geographical distribution of species, but in consequence of his death and my own ill-health this project was abandoned, and Mr. R. I. Pocock and Mr. Regan kindly came to the rescue and I hope will be present here to-night.

The total number of species recorded in the 'Biologia' is 38,637; of these 19,067, or very nearly half, were previously unknown. They belong to 1373 genera, and are illustrated by 1173 plates containing 18,051 species, mostly coloured.

Although the 'Biologia' contains the record of such a large number of species, it is but a fragment of what may yet be obtained. The whole work must be looked upon as only a contribution to our knowledge of the subject, and I hope it may be an incentive to others to carry it further.

Dr. H. GADOW, F.R.S., F.Z.S., illustrated his necessarily very condensed remarks by slides of maps showing the present physical features of Mexico and Central America, and of hypothetical

restorations of the distribution of land and water during previous geological epochs. Also a faunistic table.

The Neotropical and Nearctic faunas and floras do not meet at the Isthmus of Panama, but in Mexico. The isthmus was originally very much broader.

The various groups of the fauna seem to fall into three categories:—

1. Those which are of undoubted northern provenance. Some of these stop with the plateau; others descend thence into the hot lands, and most of these continue into Central—even far into South America.
2. Those which are of Southern, Neotropical provenance. Many of them have overrun Central America and extended into Mexico, where their current has, so to speak, been divided to east and west by the wedge-like plateau.

These two main categories interdigitate, with many complications. Some have become derelicts in their new home, whilst they have died out in their older home, *e. g.*, Tapirs. Others have hooked back, not the families, but genera and species rather, *e. g.* Opossums and the Tree-Porcupine *Erethizon*.

3. There is a considerable number of forms, drawn from all classes, which seem to be endemic, rather archaic, developed into what they are on the spot. They are the most interesting and most difficult to interpret.
- 3 A. Some seem to be real aborigines. 3 B. Others are neither from North America proper nor from South America. They must have come from elsewhere. Some of these puzzling groups seem to be a legacy from a more western extension of land, say from Lower California to the Galapagos and South America, analogous to the "Andines" of botanists, which date back far into the Cretaceous period.

Others point unmistakably to Mediterranean lands and to Africa. A "land-bridge" implies also coasts with all their concomitant physical features, suitable land-conditions for terrestrials and freshwater-fish, shallow seas for corals and shells, etc. Such "bridges" need not have ever existed in their entirety, being rather like changing pontoon-bridges. Such restorations rest upon circumstantial evidence; much of it will, no doubt, be ruled out of court, but there is a great deal of cumulative evidence and much that is mutually supporting (both negative and direct) presented by plants, Vertebrates, and Invertebrates, terrestrial and marine, so that the Afro-American connections are becoming more than a good workable hypothesis. The chief question is now, how long and into what geological groove did they last? Did they last long enough, say into the Oligocene, to be available for comparatively recent groups?

Dr. A. SMITH WOODWARD, F.R.S., V.P.Z.S., remarked that nearly all the vertebrates in South America which seemed to suggest a direct land-connection with the Old World through Africa, were either late-Tertiary immigrants from North America or senile members of pre-Tertiary cosmopolitan groups. Most of the resemblances in the faunas of the two countries usually noted were in animals of which the ancestry was entirely unknown. The only resemblances already explained by palæontology were due to the survival in the two southern continents of remnants or refugees of formerly widely-spread faunas, which had become extinct in the more progressive northern hemisphere. Palæontologists began to distinguish between the characters of animals which were real marks of affinity and others which were the inevitable and oft-repeated concomitants of maturity and senility in a race. It must be possible to distinguish these characters in a group of animals before the latter can be used in discussing questions of geographical distribution.

Mr. C. TATE REGAN, M.A., F.Z.S., said :—South America has a very rich and varied freshwater fish-fauna; with the exception of the Osteoglossidæ, a generalized and ancient group represented at the present day by a few remnants, it has not a single family in common with either North America or with Australia. On the other hand, three South-American families, Lepidosirenidæ, Characidæ, and Cichlidæ occur also in Africa, and the South-American Catfishes of the family Pimelodidæ are closely related to the Bagridæ of Africa and India.

If South America and Africa were one continent in Cretaceous times, and the connection between them persisted until the beginning of the Eocene, these facts would be satisfactorily explained. Alternative hypotheses are that the families common to South America and Africa were formerly marine and entered their rivers from the sea, or that they were formerly northern and migrated southwards, becoming extinct in the north. Against the former it may be urged that the Lepidosirenidæ are obviously adapted for life in fresh water and unfitted for life in the sea, that the Characidæ are Cyprinoids, a strictly freshwater group, and that if the Cichlidæ were formerly tropical shore-fishes, entering rivers, it is curious that they did not establish themselves in the southern rivers of North America. The second hypothesis is unsatisfactory, for when the slowness of dispersal of freshwater fishes is taken into account the improbability is great that several groups should have made these extended journeys, with the final result that closely related genera arrived in Africa and South America. Hydrographical changes, such as the union of rivers formerly distinct or the capture by one river of the tributaries of another, are the means by which the dispersal of freshwater fishes is accomplished; for such fishes migration appears to be difficult, survival relatively easy. No known northern fossils can be referred to these African and South

American families, and there is good evidence that the main distribution of freshwater fishes changed but little during the Tertiary. The Eocene *Priscacara*, from the Green River Shales of Wyoming, is, in my opinion, not one of the Cichlidæ; it belongs to the North-American family Centrarchidæ, and is closely related to the modern *Eupomotis*.

When we get to know something about Cretaceous freshwater fishes new light may be thrown on the problem. But for the present the hypothesis that South America and Africa were formerly one continent is the one that offers the most reasonable explanation of the relationship between their freshwater fishes.

Mr. R. I. Pocock, F.R.S., F.L.S., F.Z.S., remarked that evidence for the former existence of a tropical or southern Atlantic connection between South America and Africa was supplied by the following, amongst other, genera of Arthropoda:—

PROTOTRACHEATA.—*Peripatus* is confined to tropical West Africa and tropical Central and South America and the Antilles. *Opisthopatus* is found only in Chili and Cape Colony.

DIPLOPODA.—The Spirostreptid genus *Orthoporus*, which is of wide distribution in tropical America, is very closely related to tropical African, but not to tropical Asiatic, millipedes.

CHILOPODA.—*Parotostigmus* occurs in tropical America and Africa, but not in tropical Asia. *Scolopendra* (*s.s.*) is mainly tropical and Central American, but in the Old World it has been recorded from the Cameroons, the Canary Islands, Arabia, and Sokotra.

SCORPIONES.—Of the three tropical American genera of the Scorpionidæ *Opisthacanthus* has its nearest ally in the tropical and South-African *Opisthocentrus*; and *Diplocentrus* and *Oiclus* are closely related to the Arabian and Syrian *Nebo*, the three together constituting the well-marked subfamily Diplocentrinæ.

ARANEÆ.—The Sicariidæ (*s.s.*) range in America from Chili to Costa Rica, and are only found elsewhere in the world in South Africa. Of the three genera of Caponiidæ *Nops* and *Caponina* are tropical American, *Caponia* South African.

In the case of the above-mentioned Arthropods no reason can be assigned for their extermination elsewhere in the tropics, if they are the only extant representatives of genera formerly widely distributed in the Northern Hemisphere.

In the case of the Mammalia the evidence rests mainly upon the present distribution of the three following orders:—

SIRENIA.—The Manatees (*Trichechus*) are restricted to the rivers and estuaries debouching into the Atlantic on the African or eastern side and on the American or western side. These animals do not venture out to sea, and no extinct representatives of the genus appear to be known from European or North-

American deposits to support the theory of its former extension into northern latitudes.

RODENTIA.—The headquarters of the Hystricomorpha at the present time are South America, where they date back to the Upper Miocene. The only North-American representative of the group is the tree-porcupine (*Erethizon*), a late immigrant from South America. No extinct representatives of the group have been found in early or mid-Tertiary strata in North America. But in the Old World alleged representatives of the suborder, referred to the family Theridomyidæ, occur in Eocene and Oligocene deposits in Europe, and at the present time several genera of Octodontidæ occur in Africa, and the Hystricidæ range from Africa through Southern Asia to Borneo.

Until evidence for the existence of this group in early and mid-Tertiary or Cretaceous times in North America is forthcoming, it cannot reasonably be claimed that the South-American forms are descendants from ancestors from the North; and if the theory of raft-transportation from Africa be rejected, it must be conceded that the faunistic similarity between tropical America and Africa in this respect supports the idea of a transatlantic land-connection between those countries.

PRIMATES.—The past and present distribution of Monkeys is tolerably similar to that of the Hystricomorph Rodents. The Platyrrhini are restricted to South and Central America, where they date back to the Upper Miocene. No fossil monkeys have hitherto been discovered in North America. Similarly, the Catarrhini are confined to tropical and temperate countries of the Old World, and have been recorded from middle and later Tertiary deposits in Europe and Asia. The available data, therefore, point to the entry of monkeys into South America from the Old World by means of a southern transatlantic land-bridge, unless it be claimed, as it has been claimed, that the resemblances between the Platyrrhini and Catarrhini are due to convergent descent from Lemuroids of the New and Old Worlds respectively, a view from which Mr. Pocock expressed dissent.

Dr. C. W. ANDREWS, F.R.S., F.Z.S., remarked that if a land-bridge had existed between Africa and South America in Tertiary times one would expect a more extensive mingling of faunas than had actually taken place. Even in the Eocene both continents must have had a varied mammalian fauna, yet it is only claimed that the Primates, the Hystricomorph Rodents, and perhaps some Insectivora crossed from Africa to South America, no interchange in the opposite direction being known. Of these groups the Primates are represented by numerous small lemur-like animals in the Eocene of North America, and it is thence that the colonization of South America probably took place, although at present the group may be unknown from the older tertiaries of that continent. The Hystricomorph Rodents are represented in the Eocene and Oligocene of the Old World by numerous

species referable to the Theromyidæ; these are all small animals and seem to have been very abundant, so that, like the rats and mice of to-day, they would be especially liable to accidental transport. The same may have been the case with the Insectivora. What really happens when a land-bridge is established is well shown in the intermingling of the faunas of North and South America after the establishment of the Isthmus of Panama at the end of the Miocene or beginning of the Pliocene period.

Lord ROTHSCHILD, D.Sc., F.R.S., F.Z.S., said that while in no way wishing to oppose the views of the speakers who preceded him, he thought, and had always thought, that in many cases the supposed relationship of the faunas of widely separated areas was more apparent than real, and that many of the instances usually quoted were cases of convergence or parallel development. This could be easily explained if we considered that the chain of evolution of all species owed its commencement to a stimulus due to the external environment the species found itself in, causing variation to proceed in a certain direction. It is also as easily conceivable that a similar or even identical stimulus might start a chain of variation along similar or even identical lines in two totally different areas. He instanced among birds the two snipe, *Gallinago nobilis* and *macrodactyla*, the former from South America, while the latter inhabited Madagascar. These two birds are practically identical, but had evidently had separate origins. He also instanced the genus *Mænas* among the Arctiid moths, species being found in Africa, Indo-Malayana, and South America. While in the imago the structure was identical, in the larva the difference in habits pointed clearly to a separate origin, for while the larvæ of the species inhabiting the Old World were terrestrial the larvæ of the South-American species were entirely aquatic. On the contrary, he pointed out that the case of the gigantic land-tortoises favoured the views of the previous speakers, for while at present they were confined to two small groups of islands, the Aldabra and Mascarene group in the Indian Ocean and the Galapagos Islands off the South-American coast, in Miocene times they were found in many parts of the world and the present-day forms were merely survivals.

Dr. R. BROOM, D.Sc., C.M.Z.S.—When I was a student 30 years ago the scientific world was so much under the spell of Russel Wallace that any one who ventured to suggest the possibility of a land-connection across what was regarded as a permanent ocean was looked upon as a dangerous heretic, and even now there are many who are apparently afraid to admit the possibility; yet, if there is one point on which we can be perfectly certain, it is that South Africa was connected by land with South America in Lower Permian times. Identical species of plants lived in the two continents, and we know enough of the floras of North America and Europe to feel sure that the species did not pass

from the one continent to the other by the north. We know only a very few tetrapod vertebrates, but those known from Brazil are strikingly similar to those that occur in South Africa. A few years ago I described a new specialised Mesosaurian, *Noteosaurus*, which differed from *Mesosaurus* in having the 5th digit of the hind foot very slender and provided with six phalanges. Shortly afterwards the same peculiar type turned up in Brazil. *Mesosaurus* and *Noteosaurus* were small freshwater inhabiting reptiles which might at suitable times have passed from one river-basin to another like newts or frogs, but which could never have lived at sea. It is difficult to believe that they could have passed round either the Atlantic or Pacific by the north sufficiently quickly, even if there were no other apparently insuperable difficulties, to have appeared practically contemporaneously in South Africa and South America.

We know that in Lower Devonian times the littoral fauna of South Africa was practically the same as in the Falkland Islands. We can therefore be quite certain that the oceans are not permanent, and that what is now the South Atlantic had land stretching across it in Devonian times. We may be equally sure that much of the South Atlantic was land in Permian times. There is also good reason to believe that the land-conditions continued into the Triassic and Jurassic. If the elevated conditions continued into the Cretaceous, of which there is some direct evidence, we could have a sufficient mingling of primitive forms of life to probably account for all the known peculiarities of distribution.

When in New York recently I had numerous discussions on the subject with Dr. Matthew, but while I am willing to admit that the evidence is rather against any Tertiary land-connection unless it be a Lower Eocene one, I have always felt strongly that there must have been a Cretaceous connection. The facts which Mr. Tate Regan has laid before us are, I think, quite inexplicable on any other hypothesis.

Mr. W. L. SCLATER, M.A., F.Z.S., said that he agreed with the last speaker, Dr. Broom, that it was quite possible to postulate the existence of a land-bridge between South America and South Africa in Secondary times, but that he believed that the present distribution of the ocean-beds and great land-masses had been continuous since the commencement of the Tertiary epoch, and that, so far as he could see, none of the difficult problems of the distribution of the higher groups, *i. e.* Mammals and Birds, required for their solution the hypothetical existence of land-bridges across the present deeper ocean-beds. He reminded his hearers that the comparatively short duration in time of the Tertiary epoch as compared with the Secondary and the Secondary as compared with the Primary, was not always taken into consideration in the discussion of these problems from a zoological standpoint.

Professor E. W. MACBRIDE, D.Sc., F.R.S., V.P.Z.S., in winding up the discussion, pointed out that there could be no inherent improbability in the existence in Secondary times of a land-bridge connecting South Africa and South America, for there was strong stratigraphical evidence for the existence of such a bridge across the North Atlantic. On both eastern and western shores of this ocean two sets of red sandstones with intervening coal-measures, both sets being of extraordinarily similar lithological character, represented the Devonian, Carboniferous, and Permian periods. As we receded from the coast in both directions, westward in America and eastward in Europe, we found that these periods were represented by rocks of quite different lithological characters. Geologists believed that the coastal rocks were produced by the washings from a North Atlantic continent consisting of granitic rock and that this continent lasted till the close of Eocene times.